

AN ANALYSIS AND EVALUATION OF INDUSTRIAL MAINTENANCE SPARE PARTS
STORESROOMS AND THEIR RELATIONSHIP TO INVENTORY CONTROL

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CHAPTER I

INTRODUCTION

Growing competition in all businesses and industries during the present century has made it necessary for management to turn an eye toward many industrial problems which have in the past been considered with an apparent attitude of passiveness. The scramble for control of credits, production, rates of pay, etc., has brought with it the positive need of control of inventories and of those things which have as their function some part of an overall scheme by which a business or industry is controlled, either physically or financially. With the quickening of the pace of the commercial world, faster and more accurate methods for attending to the physical needs of plants from the machine maintenance point of view came into existence, for competition among manufacturers of machinery and the continuous increase in size and capacity of machines made it imperative to design the machinery and all its parts as accurately as possible, with due consideration for standardization and interchangeability of component parts.

Before the advent of the mass production era in the United States, the tools which were used were primarily hand tools which were owned by the craftsman and which were used by him at his private workbench. If the craftsman happened to be away from his job for the day, the other workers need not miss their scheduled work or task for that day; the missing link in the production system did not represent an indispensable

unit. But in the modern machine called a mass production plant, there are many insignificant looking facets, which, when out of operation, can cause an entire operating unit to become useless; one of these facets is the spare repair part.

The importance of the spare machine part has been considerably overlooked by many of the largest industries in business. While they have spent untold millions of dollars on the physical protection and paper control of raw materials and other stages of in-process goods, very little writing and investigating has been going on in the general category of maintenance spare parts storesrooms, their proper operation with respect to good inventory control practices, and a set of basic principles which is applicable to their type of activity as a whole.

It has been the purpose of this investigation to study stores control systems and their characteristics as pertaining to industrial maintenance storesrooms and to endeavor to determine from the study a basic system with wide application. The proposed method of approach has been as follows: (1) to make a close analysis of the ways in which the problem is being handled in industry today, which will consist of the analysis and careful evaluation of today's published writings on the subject and also personal interviews of persons active in the field; (2) the determination and evaluation of the best necessary features as reviewed; and (3) on the basis of the analysis and evaluation as mentioned above, and from two years of practical experience in the field, an effort will be made to produce the best method of stores control practice for handling the problem as described above. This approach will allow for the appropriate handling of variables peculiar to a given

activity with respect to rates of use, methods of so-called automatic procurement, and necessary variance in description. The problem lends itself to a very practical rather than a theoretical situation.

Summary of Thesis

The interest aroused in the problem presented in this thesis stemmed from a challenge to the investigator while he was employed as an Industrial Engineer in industry. Difficulties in the field of inventory control appear never to decrease but only to increase as more and more accounting for industrial operations is required by government, consequently, this investigation.

The purpose of the thesis is to investigate and evaluate the methods of operating maintenance department spare parts storesrooms and to determine their relationship to inventory control. The assumption that the spare parts are carried on the books as an inventory of monetary value is made and that they are not already-expensed items being held for safe keeping. These spare parts are presumed to be used in the maintenance of company operating equipment and not to be sold to customers.

Specifically, the approach was to seek out all the necessary requirements of an adequate economic stores control system and to attempt to adapt the principles of good inventory control to the problem; such a set of principles per se was not available.

This thesis is composed of three chapters of text, plus considerable appendix material, which came from actual operating points in industry. The photographs in the appendix came specifically from an attempted solution of the problem in one specific plant.

There is a brief introduction of the advent of the problem and the importance of its solution in industry. A statement that the purpose

of the investigation was to study stores control systems, their characteristics as pertaining to maintenance spare parts storesrooms, and the intent to determine from the study basic requirements for wide application was made.

A study of the writings which have been published in regard to the subject during the past five years, plus two years of actual applied experience of the writer on the problem in industry during the years 1950, 1951, and 1952 is incorporated. Few direct quotations are used, because much of the reviewed literature could be stated factually, and a considerable part of it is in line with the experience of the writer.

A sincere effort to maintain intellectual honesty in the presentation has been sustained with the hope of excluding bias.

General and specific conclusions reached with the survey of the literature and the result of the personal industrial questionnaire kept clearly in mind are made at the end of the body.

The appendix material includes certain graphical pictures and photographs which add to the authenticity of the text; and a list of the industries which cooperated in this work is compiled with an unidentified tabulation of their replies also presented.

The net result of this study is the determination that the general pattern followed by the bulk of the companies studied, and by the writers of the reviewed literature, is such that most of the individual solutions are specifically local to each industry and do not apply in a broad sense to the same type problem in other industries.

The general problem which was originally faced was stated to the Systems Department of Remington Rand, Incorporated, in New York, and the

specific reply to it was, "We have found that the same problem is present nationally, as you have observed it locally". With this statement coming from such a reliable source, it is assumed that the facts presented here are reliable on a national scale.

CHAPTER II

REVIEW OF THE LITERATURE

What Others Have Done in the Field

The search.--A comprehensive search of the literature in the industrial periodicals, handbooks, texts, and personal interviews has produced a heterogeneous collection of information which does not reconcile itself into a desirable pattern of uniformity. Evidence of industrial training and projected organized programs of good storekeeping practices coupled with good industrial engineering principles has been found wanting, and no set of concrete fundamental concepts has been observed.

This search has been focused on the stores control problem as presented by the maintenance department spare parts stores and inventory system. All articles which have been published on the subject during the past five years have been used wherever applicable, and a detailed study of the problem as it applies to fifteen prominent industries has been made. The results of these personal interviews may be found in the appendix.

What is Inventory Control

Relationship between stores control and inventory control.--Inventory control is actually the regulation of the value of any specific item or groups of items which may be the property of an individual or of an organization. The individual may be represented business-wise as a proprietor, or the organization as a group, or as a corporation, and the

inventory may take the form of many classifications. To the accountant, inventory is a certain monetary figure on his books; to the production man, inventory is a certain product or quantity of products; and to many unskilled workers who must actually physically count stock periodically, the term merely means another day's work and possibly some overtime pay. The interest of this study has been in the methods of physical control and some degree of monetary control.

The category which has been investigated in this particular instance is that which deals with stores control as it is related to the maintenance stores department of any individual plant where it is necessary to keep spare parts and supplies on hand for the purpose of keeping production machinery operating.

There is a very definite relationship between stores control and inventory control, because in the final analysis, all owned items, whether they are machinery parts or goods in process, etc., are an integral part of inventory. The number of spare parts and the quantities of each to be stocked by a maintenance department spare parts storesroom must be studied constantly and forcefully in order to maintain the best service for the least amount of money invested. Studies made by the United States Department of Commerce have revealed that one of the most frequent causes of business failure is not the lack of potential customers and business, but faulty management.

Responsibility.--The subject of responsibility for stores control has been discussed much, and with many answers. The importance of stores and inventory control cannot be overestimated, for some of the greatest

costs and most serious business losses stem from overstocks and slow turnover of these stocks.(14) This fact is one which shows itself much too often in the practical operation of the maintenance storesroom. Consequently, there must be a definite decision in the direction of responsibility for the activity. One of the questions most commonly asked is whether or not the stores department for maintenance should be placed under the jurisdiction of the purchasing department, should it be a separate department, should it be supervised by the production department, or should it be a part of the maintenance department. This investigation has found all of these situations present in practice today. There are also other facets of the problem. A study which was conducted in 1950 revealed to the (one) investigator certain facts which led him to the conclusion that

1. The broad functions of materials control, including both the policy function of inventory control and the administrative control of physical stores is primarily related to the purchasing functions along with actual procurement of purchased items.
2. The majority of companies place stores operations directly within the jurisdiction of the purchasing department.
3. The trend is strongly in this direction.(17)

To bring to light one of the other attitudes of industry relative to jurisdiction, C. C. Winston in his article, "How to Set Up a Maintenance Stores Department"(17), stated that

In this activity the storesroom is under the purchasing department, but the primary authority is in the hands of the maintenance engineer. Any stores activity is only as good as the personnel operating it. Stores personnel must be very industrious and well trained.

It should be brought out that purchasing the economic quantity is extremely important, and stores-keeping and inventory control should be

supervised by the department that has the most immediate and direct relationship with inventories. There are many theoretical mathematical relationships which propose to evaluate the economic purchase quantity, but the solutions demand uniform data for their correct operation. Stores consumption is predictable only through statistical means, and the scope is too broad for this study. Algebraic formulae are no panacea for "how much how often". Brown and Doris(2) express an opinion which leans toward the purchasing department having this authority and responsibility. In many plants, as has been previously stated, inventory control is the responsibility of the production department. However, the bulk of the support as reviewed for this presentation points toward the placing of managerial responsibility for the stores department on the purchasing agent. If the stores function is under the production department, much of the time will find the production department personnel "forgetting" completely about the necessity of ordering parts and materials. It can never be denied that the responsibility for maintaining inventories at figures neither too low from the standpoint of inventory safety nor too high from the standpoint of investment rests with the purchasing agent. However, it is necessary for all departments which are concerned with maintenance spare parts to work together with maximum cooperation. Where the stores department is under the jurisdiction of the production manager, confusion is likely to come as a result of the division of responsibility and authority.

Advantages of inventory control.--We will often find "inventory control" used to mean one thing when the reader might accept it as another; it has been previously stated that to the accountant it will mean a monetary

figure, whereas to others it may mean physical control, without translation to a monetary value. One author states that

Inventory control facilitates operations by providing the type and quantity of articles needed, at the time required, with a minimum of investment. Specifically its advantages are:

1. Investment in inventory is reduced, and turnover is increased. Control of the physical size of stocks and the development of the most economical amounts and varieties to be carried result in lower taxes, insurance, storage, and handling costs.
2. Production delays are reduced because an available supply of materials is assured when and in the manner needed.
3. Savings on results when requirements can be accurately gauged on the basis of recorded experience.
4. The risk of duplicating orders or replenishments of supplies is minimized because a record exists against which all purchase requests can be checked.
5. Loss of stock through carelessness, damage, and dishonesty is reduced.
6. Less space is wasted in storing because of proper location and arrangement of materials.
7. Available stocks can be better utilized by substituting or transferring items between departments or plants.
8. Cost-accounting activities and the analysis of consumption figures, price trends, and comparisons of performance between commodities, departments, and periods are facilitated.
9. Deterioration and obsolescence of stock are minimized.
10. Inactive and obsolete stock can be more easily located and proper disposition made.(2)

All of the above advantages may be translated effectively into the control of stores as it is related to machinery repair parts and maintenance operating supplies. Often as not there will be from three thousand to fifty thousand different kinds of machinery parts and supplies in one industrial maintenance spare parts storesroom; in one of the companies studied in this specific investigation, the stores

department is custodian of ninety thousand items. In certain government agencies there are approximately one million five hundred thousand supply items; of this number, there are more than one million three hundred thousand items of technical equipment and spare parts. It is obvious that all possible advantage must be taken of the inherent assets of positive identification, standardization, and proper application of good inventory control techniques.

Since spare parts per se are often not considered inventory assets in some concerns, they may be so considered in others; spare parts and standby parts which might be considered fixed assets in some steel mills are a true inventory asset in public utilities, airlines, or railroads. One of the companies which has contributed to this recorded information is a steel mill, and in this particular case, the spare parts assets are definitely an inventory which is controlled by recognized perpetual inventory procedures. Proper methods of inventory control, when applied to spare parts provide, for all persons concerned, the information, (1) what is on hand, (2) how much is on hand, and (3) where the items are located. Furthermore, inventory control on a continuous basis can provide readily such information as, (1) the money value of the stock, (2) the recognition of slow-moving items, and (3) necessary facts to aid in keeping active items fluid from a rate-of-turnover point of view.

Storesroom for the Maintenance Department

Storesroom is essential.--A storesroom for spare parts for the maintenance department is as essential to its proper functioning as is much of its machinery; a good maintenance program in industry requires

that there is a preventive maintenance program. If the program is carried out properly, then there will be recorded usage of parts and supplies, which will indicate the frequency of use and quantity of purchase for these items; this procedure ties in directly with the accomplishment of having the parts needed, when needed, and where needed, all without the company having too much money invested in spare parts.

Location.---The storesroom should be located in a spot which is best suited for obtaining maximum benefit from its existence. There are some members of management who advocate a large, centralized storesroom which is located inside or near the factory as being the best arrangement, because either location permits relatively easy control of stock. However, since both quick issuance of material and minimum storage costs are desired, it is sometimes desirable that shop storesrooms be placed close to the centers of production. It is further desirable that all regular stock items be assigned permanent storesroom locations, with irregularly stored items being given a location only when required. Once the irregularly stored item is given a location, it should be cared for just as painstakingly as the regular type item. A system such as this avoids holding valuable bin space in reserve when it should be in active use.

Designing the Storesroom

Proper equipment is necessary.---There are several requirements which must be kept in mind when the storesroom is being designed. The nature of the stored parts must be considered when the layout is made, and proper lighting, width of aisles, colors of walls, ceilings, bins, etc.,

must be considered. The cubic space must be studied and allotted properly in order to utilize completely all storage facilities; the protection of materials against deterioration, theft, or removal by persons without authority must also be taken into account. In the case of the bins, they should be open front, for ease of access is worth money to the company when the time saved is translated into money.

Rota-bins may be used for storage of parts such as small hardware and small electrical parts; they are also suggested for use in connection with many "free" items. It is noted here that "free" items are those which are small enough and inexpensive enough in the whole scheme of things to make no appreciable accounting error. Some free items are determined to be such when the processing of withdrawal slips, or storesroom requisitions, costs more money than the actual cost of the item when purchased.

Brown and Doris(2) have made clear mention of their views on equipping the storesroom by generalizing that the equipment of any particular storesroom must fit the specific needs of its storage requirements. The flexibility of the storage units must be taken into account and a comparison of various types of multiple units is desirable. Although wood is cheaper for bins, it is not as flexible as metal; moreover metal bins will provide more storage space which will, as a rule, be cleaner than wood. In the complete design of the storesroom, some of the other types of equipment and procedures which should be considered are the possibilities of storing in movable containers, such as tote-boxes and dolly-boxes, and placing piled goods on skids so that lift trucks can be used. The latter items of equipment may be used advantage-

ously to reduce the amount of handling; a good tiering device saves storage capacity and reduces labor costs. Any reduction of cost of handling or any other reduced cost always adds to the effectiveness of an industrial system. The utilization of the full height of the storesroom can be made possible by the use of ladders on trolleys, or a set-back arrangement can be made with the second tier of shelves, say one foot, shorter than the lower tier to provide a step or platform for reaching the top shelves. There is, however, the possibility of wasting approximately forty percent cubic space in the bin area when such a tiering device is used.

Cataloging of Storesroom Items

The problem of classification.--In the cataloging of storesroom items, proper classification and identification work hand in hand. There are multiple problems which must be overcome, and it has been found that there are about as many different answers as there are problems. The problem of multiple identity of all types of supplies and materials became so difficult with the various procurement activities in the government that forty committees were set up to produce a Standard Commodity Classification. It is, in fact, an all-inclusive classification system which can, in many instances, be readily adapted to the needs of industrial concerns. The above mentioned volume applies to commodities, but there is another similar government project underway which applies to such items as technical parts and supplies.

Obvious need of standard classification of materials and parts.--Some of the dangers of faulty classification are shown in the Federal Govern-

ment quotation that

One ball bearing was variously identified under 239 different symbols, "----" 4,500 supposedly different items were actually only 879 different oil seals, "----" before classification the Navy was purchasing 100,000 different aircraft motor parts, whereas all Navy engines combined had only 8,000 odd parts."

The list of such quotations does not end with those above, but it continues to include others.

Various company approaches.--One may observe that the problem of classification and identification of parts and supplies has been attacked from many apparently random directions; the solutions represent a heterogeneous overall result.

In one particular description of the problem in a plant, the author states that it is not uncommon to have maintenance repairmen call an item by one name, the stockman call it another, and further, the purchasing department will purchase the item under still another description from the manufacturer. It has been stated that the above sort of confusion goes on constantly, especially when new employees are being trained.

Use of photography.--A method of positive description for common understanding of parts, assemblies, subassemblies, and other items which must be controlled in a stores department is simple photography (see appendix). Parts may be photographed very inexpensively and the prints placed by use of rubber cement in loose leaf notebooks to be used as catalogs. This method will provide description which both office and shop workers will agree upon. If the identification photographs are not assembled in books, then they may be filed for ready reference when disagreement on

identification occurs. A tangible result will be a reduction in requisition errors.

The question of advisability of photography of actual parts may arise, but it must be remembered that the only identification of machinery parts furnished by the manufacturer in numerous cases is a blueprint which does not, as a rule, furnish adequate information for the ordinary maintenance worker and stockman.

Cataloging aids by mechanical means.---There are numerous stations within a company where certain paper such as dray tickets, requisitions, receiving department records, etc., must be processed. These individual forms should have the same description throughout for the same item, and a widely accepted method of making this possible is by the use of addressograph plates or other repetitive printing devices. Such devices are capable of showing inventory number, classification, proper and constant description, such as category of stores, machine symbol and interchange numbers. This plate or stencil can be used to print such applicable items as bin labels, location numbers, notices of catalog changes, receiving reports, usage cards, stores requisitions, and disbursing forms. A uniform, positive, concise result in proper identification may be obtained by use of this method, but scrupulous care must be taken in order to keep the identification plates in an accurate status.

Classification of rates of use.---While the physical classification and identification of parts is necessary, the rate of use of all individual items is of great importance.

The investment in stores is also of major importance to any

business; money which is invested unwisely in shelved items should be used for working capital in other places. When the turnover of individual items is effected to cut carrying costs, the inventory investment is reduced, and this has the same effect as adding to a company's profits. In determining what the most profitable turnover rate is for a given item, it is necessary to weigh carefully the cost of acquisition against costs of possession. The rate of turnover, in stock turns per year, which gives the lowest total cost, should be considered the ideal rate.

The cost of acquisition must take into account such expenses as purchasing, receiving, inspection, rush order expense, telephone bills, accounting, and in some cases, invoice checking. The elements of cost of possession take into account insurance, taxes on inventory, capital tied up in stock, interest on capital, warehouse space and equipment, wages of stockkeepers, deterioration, obsolescence, and possible mark-downs.

Cataloging according to company assigned numbers.--The major requirement for any identification system is that the marking or classification be understandable and clearly defined. Disregard of physical identification of materials and parts leads to never-ending inventory control disruptions and to other forms of business and industrial waste. A great number of financial statements carry on their debit sides the effects of neglect in this area of inventory management. The loss may be of a direct nature, which can be caused by lack of proper identification or from other causes such as improper purchase because of inadequate description. One of the greatest causes for these debits, an indirect one, is faulty records,

ineffective stores operations, and ineffectual controls.

There are numerous approaches to the solution of the number classification or name description of parts problem. Individual companies have made efforts to use their own numbering systems for all spare parts received by them, disregarding to some degree the descriptions of the vendors. An example of this approach is exemplified by D. J. Godschall in the lengthy quotation taken from his article, "Now We Have Repair Parts We Need When We Need Them", in *Factory Management and Maintenance*, Volume 108, Number 9, September, 1950

Problem: How can we identify repair parts? We need common classification and common identification for both craftsman and storekeeper. The problem of name is a most serious one, so we need machine parts manuals; the repairman calls the part one thing, and the manufacturers call it another. Here is our answer to identity: separate "known" stock from "unknown" stock. Create a "bone yard" for the unknown stock and use from it as much as possible; do not throw away unidentified parts.

Answer: We give all repair parts our own serial numbers by doing two things: first, we request drawings and parts lists from machine tool manufacturers. Some of the manufacturers have none to give, and others are reluctant; second, we correlate our own parts numbers with the manufacturers' identification.

Here is an example of our procedure: We use "HMP" where the item is a Heintz Maintenance Part or "HMA" where an assembly is stocked. Our numbers are assigned consecutively, regardless of type of machine, from an index we keep for that purpose. They begin at HMP 100, and they have now reached HMP 8100; any number will do the job as long as you keep it cataloged.

One of the most important elements in the scheme is getting HMP identification marked on parts. We requisition all repair parts by HMP numbers as well as by manufacturers' specifications, and we request the vendor to label HMP number on parts before delivery on shipping papers; every part must have HMP number on it before going into stock bin. To close the gap completely, we stock all parts by HMP numbers. We use a visible card record system for inventory control, one card for each item. The mechanical items get green cards; electrical items get pink cards. The cards are indexed by HMP numbers.

When we built up a machine parts manual, it was necessary to reduce myriads of manufacturers' specifications to HMP numbers. How, then were we to make workers understand and use that language? This is done by using this machine parts manual. It contains some eight

volumes of letter size post binder covers; each holds about two hundred pages of data sheets, and these sheets are sub-indexed by type of tool or machine. For each type of tool or machine we have parts drawings marked with manufacturers part number and name, then show HMP number for each of the parts we stock and highlight it with a red dot. If the part is Heintz made, it is marked with a cross. When parts are used interchangeably they are cross referenced on the machine drawings. We have five sets of identical manuals, and they are placed in each of the following places: 1. Storesroom, 2. Plant Engineer's Office, 3. Electrical Department, 4. Mechanical Department, and 5. the Purchasing Department. The use of this method makes nomenclature a cinch, but it takes much time to catalog machinery; it is almost a continuous task. Existing sheets must be kept up, and new machinery must be cataloged. When we order parts which will be cataloged, we always ask the vendor to furnish us with five copies of drawings so that we can use them in the post binder catalogs which are used by us. If we cannot get the drawings, we make photographs in the white print stage; these pictures are then marked with HMP numbers.(6)

Location number system for finding individual parts.---In the spare parts storesroom of companies where this activity is large enough to warrant more than one employee, the number of different items must be considered large enough to require a bin location number system for all items kept in stock. A complete location index is necessary in order to expedite proper withdrawal of those items which must be issued. Here again positive proper identification plays its important role in the entire operation of stores control.

There are several accepted methods of producing workable location systems, any one of which would be satisfactory from a theoretical point of view. However, the most important thing about such a system is that it must be usable in a practical sort of way.

In order for the classification system, the identification system, and the location system to work completely and together, there must be a suitable catalog for the storesroom available to furnish the compiled information to those who must use it in order to locate a part. The

essence of the system must be simplicity.

Location catalogs take the form of manufacturers' catalogs with location numbers added, loose leaf books as mentioned in the foregoing section on company-assigned numbers, visible card filing systems, and in some instances, the very effective form of tub files. It is always necessary to retain the location index in the storesroom proper and not in some other department area. Operating a maintenance spare parts storesroom is a twenty-four hours per day task when done properly in a plant that operates the same number of hours per day; if persons other than the storesroom crew are allowed to draw parts, then the location index must be of such a nature that the inventory accuracy will not be jeopardized.

The physical arrangement of the sections of bins and shelving in the storesroom area must be considered with some discretion prior to the assignment of bin numbers. All numbering systems should be set up on the principle of three dimensional coordinates; aisles, rows of cabinets, individual cabinets, shelves, bins or drawers, and sub-compartments in the drawers must have a number and/or letter designation. The evidence shown in this investigation points out that a low percentage of activities use a detailed location number system. The instructions given to new employees is verbal, and the chance of error is increased when compared with formal written instructions for storesroom procedure.

Operating the Storesroom

The need.--It has been mentioned before that a storesroom for maintenance spare parts is necessary if the company does any of its own repairing of production machinery; one hundred percent of the industries inter-

viewed do their own maintenance work except on specific highly specialized requirements. In order for the storesroom to function as a complete unit, it must be recognized as a separate activity set apart from other departments in a cooperative manner in order for the maintenance department to do its job. If there is mixed responsibility and authority, then its program will be a failure from its inception.

Record center.--There is great diversity of opinion concerning where the actual physical records of balance of stores inventory is to be kept within an organization. It can be seen from question number twenty-five in the Appendix that there is little or no uniformity in industrial practice as investigated in this problem. Certain advantages may be projected for all of the possible suggestions concerning the problem; however the very nature of the parts and supplies kept will play an important role in the decision.

Vaguely identified parts.--Countless industries operate plants in which obsolete machinery is still producing profitably and for which there is no specific information concerning spare parts and supplies, yet an accurate record of spare parts must be kept for inventory purposes so that an adequate number of spare repair parts may be kept. In instances like the above it is simpler for the actual inventory records to be kept in the storesroom and the issues be deducted by persons completely familiar with the parts and with their corresponding written descriptions. There is general objection to such a practice by accountants and auditors, because their limiting principles require checks and control features which would be violated by this practice.

Experience teaches that more exact information concerning classification and identification of parts and supplies is needed than the machinery manufacturers are willing or able to supply. There are industrial machines which have as many as ten thousand precision parts in a single unit, and positive identification and specifications for parts is virtually impossible, especially when such a machine is, say, ten years old.

We have strong practical indications that the inventory records of individual parts of this type should be kept by the storesroom operating personnel in the storesroom proper; otherwise costly delays and inventory record errors are imminent. The existence of this situation is predominant, according to the bulk of published literature on the subject.

Positively identified parts.--There are some plants operating with new equipment throughout, such as emergency war plants, and plants which have complete new units added to existing facilities. They are in a good position to own complete parts catalogs which not only have exploded pictorial views of all parts but they also have a specific part number for each item. Such installations may keep the inventory records of parts in the purchasing office; the individual parts usually have their proper part numbers stamped or marked thereon, and identity is no problem. However, the location of such records in the purchasing department office requires additional cost through added paperwork, caused by the necessary processing of storesroom withdrawal slips. The existence of this situation is in the minority.

Decision on what items should be stocked.--It is a generally accepted fact that no one man can decide exactly what parts to stock, for there are too many factors to be considered. However, all requests for repair parts should be screened through the plant engineer or head maintenance man plus the head of the production department involved. This decision is left to the judgment of storesroom personnel all too often, and as a result, those in management who are responsible for the activity have sidestepped an obligation. The type of reasoning involved in making this decision will be found in management more often than it will be found in stockkeeping circles; the storesroom clerk should not be expected to make purchase decisions for parts on the basis of "ins" and "outs". It is a management decision.

Relation of receiving department to storesroom.--Reports of goods received must be furnished to the final recipient by the receiving department. The maintenance spare parts storesroom is this recipient for all items which are so channeled, and it cannot be over-emphasized that proper classification and identification must be stressed from the very beginning. Receiving department forms should be furnished to the storesroom with all items delivered to it. These forms should bear all necessary description to allow for immediate inspection for acceptance or rejection.

Storesroom personnel obligated to inspect.--The actual receiving department inspection of incoming articles will vary with each company; some of the companies are extremely strict in their policy; others inspect from certain vendors, whereas others will not inspect incoming goods at all.

The stores department is held responsible for all goods accepted by it as recorded on signed receiving slips. If the storesroom personnel accept goods without verifying their identity, then the value of the inventory control for the activity is zero. When the receiving records in the storesroom reflect actuality, then all is well with respect to records of additional stock.

The primary receiving document is the receiving slip which may be included as part of the purchase order; if the original purchase requisition has a complete description including bin location numbers and other pertinent data, then the proper placing of all incoming parts is extremely simple. If clear information is not present with the incoming part, then the proper stowing will not be without difficulty.

Placing parts where they belong.--Stores clerks must be charged with the responsibility of proper placing of all received goods. When there are assigned compartments for the items, then they should be carefully placed in the right place; when there is no assigned location, then a place must be assigned and the proper location number recorded in the location index, kept in the storesroom.

Issue of spare parts and supplies.--In the survey of published writings on storesroom systems, their controls, etc., there appeared a negligible amount of information concerning withdrawal of parts and supplies for use. The answer to this problem as described by persons interviewed in industry (see appendix) shows itself to be many-sided and without uniform consideration. Varying degrees of caution are taken with respect to what persons or positions carry the necessary authority to make with-

drawals. There is evidence that in some plants any person who works for the enterprise may make such withdrawal.

Authority to draw spare parts and supplies should be vested in responsible personnel, for in principle it is the equivalent of authorization for signing checks; withdrawals in all cases are actually the expending of company funds.

Disposition of withdrawal slips or withdrawal requisitions.--All withdrawal slips or any other instrument which represents expended spare parts or supplies from the maintenance spare parts storesroom are the official device for inventory reduction from the balance of stores record. Again it is of major importance to have the proper identification recorded thereon.

When withdrawal slips are not used for the issue of items, then a withdrawal register of parts issued should be kept, so that proper reductions from recorded stock may be made.

Posting of reductions in stock.--The withdrawal slips or withdrawal register entries should be posted to the perpetual inventory record daily so that an accurate record of stock on hand can be available and accurate within close limits at all times. As stock is reduced from each individual card or ledger sheet, an observation of the maxima and minima figures should be made. It is always desirable to have physical reminders associated with the stock records in order that continuous examination of all item records is not necessary. When such devices are used, they make a considerable contribution to saving time, reducing costs, and to increasing capacity of the storesroom activity.

So-called automatic purchasing.--Purchase requisitions from which actual purchase orders originate are prepared at all points in an organization where the authority has been given; as a rule, however, these requisitions are evaluated by necessary authority before purchasing takes place. Some of them originate in the maintenance spare parts storesroom. Some of them originate at the point where the perpetual inventory control records for the activity are kept, if they are not kept in the storesroom.

The term "automatic purchasing" is interpreted here to mean that the time to purchase any item is automatically designated by predetermined quantity figures, designating an order point or a minimum inventory quantity. Such purchasing methods are subject to much opportunity of error if they are not scrupulously tended. In order for automatic purchasing methods to have a reasonable opportunity to operate effectively and economically, the ideal rate of turnover for each individual item carried in stock must be calculated. It can be clearly seen from examination of question number twenty-one and its answers, (see appendix) that there are evidently very few industrial activities which conduct a program of perpetual inventory control coupled with automatic purchasing.

Physical inventory.--The bulk of evidence gathered in the personal industrial survey which was conducted in this case points toward a complete lack of uniform practice in taking physical inventory of maintenance department spare parts storesrooms. The practices vary from taking no physical inventory whatever to such things as preprinted inventory tickets, two-way telephone communication between persons counting and persons posting, photostats of card-visible tray filing systems to provide properly identified blank forms, and in some cases

taking photographs of actual items to be inventoried but which cannot be verified until a later date.

Nowhere in the literature or in the industrial survey made was there any evidence of a manual of instructions for taking periodic physical inventory. Experience shows that the task of taking physical inventory is made less difficult when those persons who are involved in the actual work are carefully instructed in the procedures and made to realize their important position in accomplishing the necessary end.

CHAPTER III

PROSPECTS OF A UNIVERSALLY APPLICABLE SYSTEM

Definition.--The sense of the title of this chapter is such that it actually asks the question, "Can we have a universally applicable stores control system for maintenance spare parts and operating supplies?" The answer cannot be a positive one for either of the possible answers, yes, or no. An examination of the product of the literature survey, experience of the writer, and a study of the appendix will expose the elusiveness of the problem.

A universally applicable system would of necessity be one which would apply favorably to any industrial inventory control situation, and an attempt to create such a device would cost more money than the system would be worth to the enterprise.

Each activity has its own personality.--Investigation of stores control units for spare parts shows that each activity will vary in some definable degree or use as compared with other units observed in industry. The industrial survey which is represented in the Appendix of this document reveals that there are some spare parts storesrooms which perform a double function, that of housing necessary spare parts and that of housing tools. The tools mentioned here are machine tools and not hand tools. These machine tools are perishable tools which must be replenished as consumption records indicate; they must be controlled in fact. Other activities investigated presented other characteristics

uncommon to the overall picture.

There evidently is not a readily obtainable common denominator for all different situations of the above type.

Allowances for individual activity differences.--Since each industrial enterprise will have its own manufacturing characteristics, so will each stores activity for these industries have its own operating peculiarities. All stores activities must have a definite plan of operation, however, with its operating responsibility properly placed, and there must be some yardstick with which to measure the results. Operations without controls are not desirable.

Major Requirements of Any Inventory Control System

Adequate quantities.--One of the most popular statements that is associated with inventory control is in effect that the system should provide what is wanted at the time that it is wanted where it is wanted, but such an objective is not always accomplished without considerable difficulty. There are many difficult problems to be overcome in the determination of proper quantities and the fulfillment of an adequate system. While some of the problems of creating an operating stores department are of a physical nature, there must also be the creation of a system of paper forms which will create a complete cycle of operation.

Keep investment at a minimum.--Control the investment. The very nature of control implies that there is superintendence, there is authority, there is government, there is regulation, and there is management as a whole.

In a previous chapter the idea of turnover was introduced, and it was explained that in order for the stores control system to work efficiently and adequately, the number of stock turnovers per year that cost the least would be the most profitable. This policy can be used without reservation in all stores systems unless the supply of an item is without dependence; then the complexion of the entire buying situation changes. It is more desirable that an item be purchased at a higher price than that which is customarily paid than to face the possibility of losing production time because of a shortage of repair parts.

Issue spare parts and supplies.--The management of some industrial enterprises allows all maintenance department employees to withdraw spare parts and other necessary items from the storesroom with no authority other than verbal request. If the storesroom for the maintenance department of a plant is to function properly as a controlling unit for invested capital, then a designated order of procedure of operation must be followed. If the storesroom activity is large enough to warrant a perpetual inventory system of accounting, then there should be an authorized list of persons who can withdraw parts on their own personal signature and use them in the maintenance program of the plant. Because issue of parts and supplies to unauthorized persons will have a tendency to destroy the effectiveness of the control system, this practice should be avoided.

Perpetual inventory procedure necessary.--In order for any stores control system to have an ever-ready source of information concerning quantities on hand, costs, and other necessary information available at all times,

it is necessary to maintain some specific form of a running record. These records may take the form of card visible systems, tab file systems, or a stores ledger system and the choice of one of these types should be completely dependent upon the local situation within a given activity. When the stores activity houses many parts for which there is no manufacturers' catalog or any other device of clear identification, then it is highly desirable and most effective to locate this perpetual inventory record system within the storesroom area. If there are complete manufacturers' parts catalogs of descriptions and parts numbers available, then there is no major question of proper location of the inventory record control system.

Price as a factor.--Another major requirement of any inventory control system, whether it be for spare parts and supplies or for raw materials to be processed, is the consideration of price. All spare parts and supplies which are issued to the departments which use them should be priced out by some predetermined method which is in agreement with good accounting practices. Investigation of industrial inventory control systems has revealed that in the different methods of keeping account of purchase prices and values of spare parts, possibly the two most popular are: (1) keeping total book value for item records and, (2) maintaining only the cost per item. It is a matter of accounting practice which of these two is better for any individual enterprise. The method of carrying total value per item has one outstanding advantage in that a total parts inventory value is easily obtained with a minimum amount of difficulty.

Paper Forms Necessary in Storesroom Operation

Purchase requisition.--The initial need of any item to be purchased for stock in a spare parts storesroom must originate somewhere within the program of maintenance or from an "automatic" purchasing device. In order for such a request to be satisfactory in any stores department organization, it should first be necessary that the items desired are properly identified, and that full description of them is available to buyers in order that they may make intelligent decisions in the event that the items are available on a bid basis. If the item is carried regularly as a stock item, then the assigned storesroom location number should be given in the requisition.

A system of control or restraint should be maintained with respect to authority to originate such a document, for promiscuous granting of such rights will lead to weakening of the stores control system.

Purchase requisitions take several forms, and the overall picture of their function within the company should be the determining factor with respect to their form. If there is no centralized stores control unit for maintenance spare parts and supplies, the requisition may take the pattern of a general office form. If there is a stores record card system for inventory values, then the individual card may be used for a requisition, the proper quantities, vendors, etc., being indicated thereon. The use of inventory cards, showing vendors, previous purchases, inventory records, etc., is an excellent method of eliminating most of the general forms of purchase requisitions.

Purchase orders necessary.--The forthright statement that purchase orders are necessary is to some degree in error. Purchase orders are definitely

desirable for systematic operation of a successful buying program; any system which does not use them should be avoided. Purchase orders are nothing more than their name implies. The original copy is filled out in strict accord with the purchase requisition, and adequate copies are distributed to those points in the company that are concerned with them. Observation of purchase order use indicates that there are approximately eight copies of each order at its point of beginning; these copies are distributed to all points within the company where there is an official interest in the order. The original copy should go to the vendor and at least three copies of it should stay in the purchasing department office; these should be filed by vendor and by numerical order for cross indexing needs.

The receiving department, or that activity serving the purpose of a receiving department, should receive three copies in order to have on hand an adequate description of expected incoming parts and from what vendor they are being delivered. Other copies of the order which are distributed to the receiving department go to the departments receiving the goods (such as the storesroom), and one copy is retained, signed by the storekeeper, in the receiving department files; the recipient should always retain a copy for his own files. In the case of partial deliveries, a different procedure should be used for successful operation.

One of the copies of the purchase order which is retained by the purchasing department should be used for reference and comparison when invoices for payment for goods are received; if the accounts payable department receives and clears the invoices, then this copy of the purchase order should be held by that department instead of the

purchasing department. Purchases without purchase orders should be avoided with great care.

Receiving reports.--The first station of obligation of any company which purchases from suppliers is the receiving department; this fact is true for all enterprises then, for all of them must buy from other industries. The receiving department is the first agent of the buyer to take official custody of shipments. At this point the receiving report originates, and the receiving department either accepts or rejects incoming merchandise, thus obligating it to the vendor. This department should not accept any materials of any sort unless there is on hand in its office a copy of the purchase order from which the merchandise was bought. The incoming bill of lading should have written thereon a purchase order number to agree with the order number held by the receiving clerk. When these requirements are met, then the purchase order copies on file in the receiving department may be used as receiving reports, provided that the shipment is not what is referred to as a partial shipment.

The size of the company and the volume of necessary receipts of goods from outside sources must be determining factors in the elaborateness of a receiving system, but it should be borne in mind that all of the goods purchased must be checked and accepted prior to authorization of payment for them. Relaxed receiving and inspection practices must be avoided if the receiving and stores activities are to be successful.

The report which was previously referred to as a partial receiving report is made out by the receiving clerk when an incomplete order is to be received. This simply means that a separate acceptance

sheet is typed for those incoming articles, and they are deleted from the copies originally held by the receiving clerk.

When the proper paper work is done for incoming items that are scheduled to go to the storesroom, two copies of the report go to the storesroom with the articles to be delivered. One of these copies is signed as a receipt by the stores clerk, and one is retained for the storesroom record. Once the storesroom has received the merchandise from its source of supply, the quantities received must be posted on the balance of stores record.

Balance of stores record.--All systems of perpetual inventory control must have some workable form of a balance of stores record. This record is regarded as the most important single form used in a continuous system of inventory regulation. It is essential whether the system has universal application or whether it is a specialized application. The time of the first attempts to maintain inventory control marks the beginning of such a record, and from this beginning its use has been extended to meet the demands of production planning and accounting.

The required information which a universally usable balance of stores record should show would give a complete picture of all the characteristics of interest concerning the spare part or item of supply that it records. Alford, in his "Principles of Industrial Management", gives seven essential requirements which should be shown by a complete system of inventory control balance of stores record, which may take the form of ledgers, cards, or loose leaf binders:

1. An accurate description of the material.
2. The factory or machine requirements of the parts or supplies in question.
3. The quantities "on hand," and allotted to planned use."
4. The quantity to be ordered when the time comes to procure a fresh supply to build the bin stock up to its maximum inventory quantity.
5. The unit price of the part or supply which is to be used in charging this item to the activity ultimately using it.
6. The history of consumption of the item during given periods of time; this record assists in the determination of proper cost calculations.
7. The value of the quantity on hand.

In any activity using such a plan, the balance of stores record should be maintained at the point where maximum accuracy and minimum paper work can be obtained. Some accountants will disagree with the above statement, because the location of stores records in the stores-rooms is often a sound practice.

There is always the possibility of employee dishonesty lurking in the operation of any activity which houses items that can be of personal usefulness to workers. When the balance of stores records are kept in the proximity of the actual stored items, the choice of attendants must be painstakingly made.

Identification tags.--One of the most overlooked items in stores control systems as investigated here is the identification of items stored, i. e., the actual physical tagging of the parts. It is not necessary to tag more than one individual price or complete part in a given bin, but the importance of identity cannot be overstressed. There are duplicate

tags to be had for such use, and they can be printed in blank fill-in styles in order to minimize effort on the part of the stores clerk. This identification tag is made such that the top page is carbon-backed clay-filled writing paper, and the part which remains tied or wired to the part is made of tagboard. Pertinent information and clear identity may be handwritten on the face of the carbon set, the tag placed on the part in the bin, and the top copy may be routed to the balance of stores center for recording as increased inventory. Whenever the parts are properly marked in their assigned bins, the tag above is not necessary, and the receiving copy which accompanies the parts to the storesroom may be used for evidence of increased inventory. Care must be taken not to make entries from both the bin tag original copy and also the receiving record. This type bin tag is not an inventory record, and care should be used in prohibiting this misunderstanding.

Withdrawal requisition.--The authority to draw money from a checking account lies in the properly authorized check; the same principle applies to the withdrawal of spare parts or any other item which is housed for safekeeping, if the operation is set up on the premise of perpetual inventory control. There can be no control without delineated authority.

The withdrawal requisition is nothing more than a written authorization originated by proper authority for the bearer to withdraw the described article from the storesroom. This withdrawal requisition should give clear identification of the item, the purpose for which it is being used, the machine or department to which the item will be

charged, and the storesroom location number.

The next disposition of the withdrawal requisition should be to the balance of stores record system center where the quantity will be reduced from record, and then to the accounting department where the proper account is debited the value of the item. A satisfactory perpetual inventory program must work on the principle of a double entry bookkeeping system.

There are instances where almost all of the office and other clerical work is done by several persons and not by a large organization; however the application of the principles set forth herein apply throughout.

Return to stock forms.--The withdrawal requisition was explained above, and its disposition was noted. In the event that stock items are withdrawn and subsequently not needed, they may be returned to stock in the storesroom for credit. This form takes the same route as the withdrawal requisition except that the item previously withdrawn is returned to stock in the proper bin, the balance of stores record takes the item back into stock, and the accounting department credits the account which was previously debited when the article was withdrawn.

CHAPTER IV

CONCLUSIONS

1. The policy of maintaining written manuals of instruction for effective operation of maintenance spare parts storesroom is grossly neglected.
2. The maintenance spare parts storesrooms investigated serve the company maintenance departments almost exclusively, and very few parts for outside specialty maintenance are stocked.
3. All companies studied employ a full time maintenance crew for their own machinery, and then call in a minimum of outside assistance.
4. The majority of companies studied stated that they had a stores department, but its system of operation was lacking in effectiveness.
5. There was no uniformly used paper control system in the survey and none in the companies personally interviewed. The answers to the inquiries presented a heterogeneous result.
6. There is close adherence throughout the companies interviewed to the principle of periodic disposal of obsolete parts.
7. With regard to the practice of identification, there was the almost unanimous adherence to manufacturers' catalog description. There was evidence in the literature survey, however, that some enterprises adapt their own parts numbering system.

8. Approximately fifty percent of all storesroom systems are planned and the same percent "just grow".
9. All of the companies interviewed stated that their storesroom systems were obtaining adequate results.
10. Sixty percent of the stores systems studied did not use a storesroom number location system.
11. There is a "free issue" system of issue used in more than fifty percent of operating maintenance spare parts storesrooms.
12. The trend points toward responsibility for the storesroom to rest with the purchasing agent; however, the industrial survey used in this study gives a scattered pattern of responsibility.
13. The authority to originate purchase requisitions for parts to be stocked in the storesroom seems to be widespread among company personnel.
14. There appears to be no consistent policy concerning persons authorized to withdraw spare parts and supplies.
15. No uniform practice of the record center for balance of stores records is indicated by the industrial survey.
16. Thirty-three percent of the companies interviewed maintain a running physical inventory check on spare parts; others make either a periodic count or they take no inventory at all.
17. None of the interviewed industries use a mathematical approach to determine economic purchase quantities; experience and recorded usage dictate purchase quantities.

18. The study produced a varied assortment of procedures and practices for taking physical inventory, some of which show very practical usefulness.
19. No uniform practice of maintaining uniform stock levels was observed.

Specific Conclusions

1. No specific universally applicable system of stores control for spare parts was observed.
2. No practical universally applicable system of operating maintenance spare parts storesrooms is feasible; in order to embrace the myriads of possible situations, the resulting system would depart from simplicity.
3. There are considerable amounts of money being wasted by management through negligent stores control policies.
4. The application of good industrial engineering techniques in maintenance spare parts storesrooms is grossly lacking.
5. No specific formal training program for stores control operations was observed; the apprentice methods of training through worker observation are predominant.

A P P E N D I X

EXAMPLE OF APPLICATION OF SIMPLE PHOTOGRAPHY
TO PRACTICAL CASE IN INDUSTRY

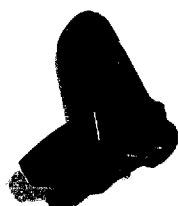
PRACTICAL PICTORIAL APPLICATION
TO IDENTIFICATION OF SPARE PARTS

Physical identification was stressed in the text of this work as being of outstanding importance, possibly the most important single factor in the operation of a stores department.

Solution to the problem cannot be standardized because each individual situation has its own characteristic needs, however, FIG. 1 and FIG. 2 show positive, accurate approach to a practical solution. All of the items pictured are small parts which are used in various critical places in a high speed paper folding and glueing machine used in the kraft paper board converting industry. There are approximately twelve thousand parts to each of these individual production units, and there are no pictorial catalogs for them available to industry for proper purchasing of repair parts.

It can readily be seen from the nature of this specific case that simple photographic records as presented here can be one of the most economical, and by far the most accurate methods of spare parts identification.

One may take particular note of the circumstances which surround these particular production units. The original model machine was made by its inventor company, World War II brought the need for added machines for folding carton production, and still a third company gained all manufacture and patent rights to this product even later. Pictures of the parts and their respective manufacturers' interchange numbers



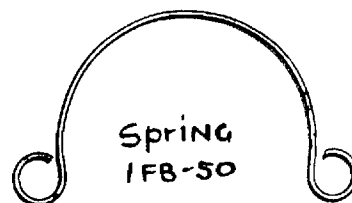
LUG
012058



BEARING
010364



SPRING
1-FC-179



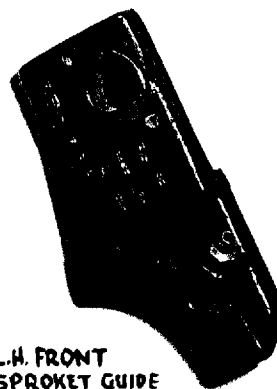
Spring
1FB-50



L.H. LOWER REAR GUIDE
012242



ROLLER
010309



L.H. FRONT
SPROCKET GUIDE
013018

FINGER, 1

FINGER,
1FG168-2



MOISTENER BRUSH
H-20101

FIG. 1

Page From Proposed Pictorial Spare Parts Catalog

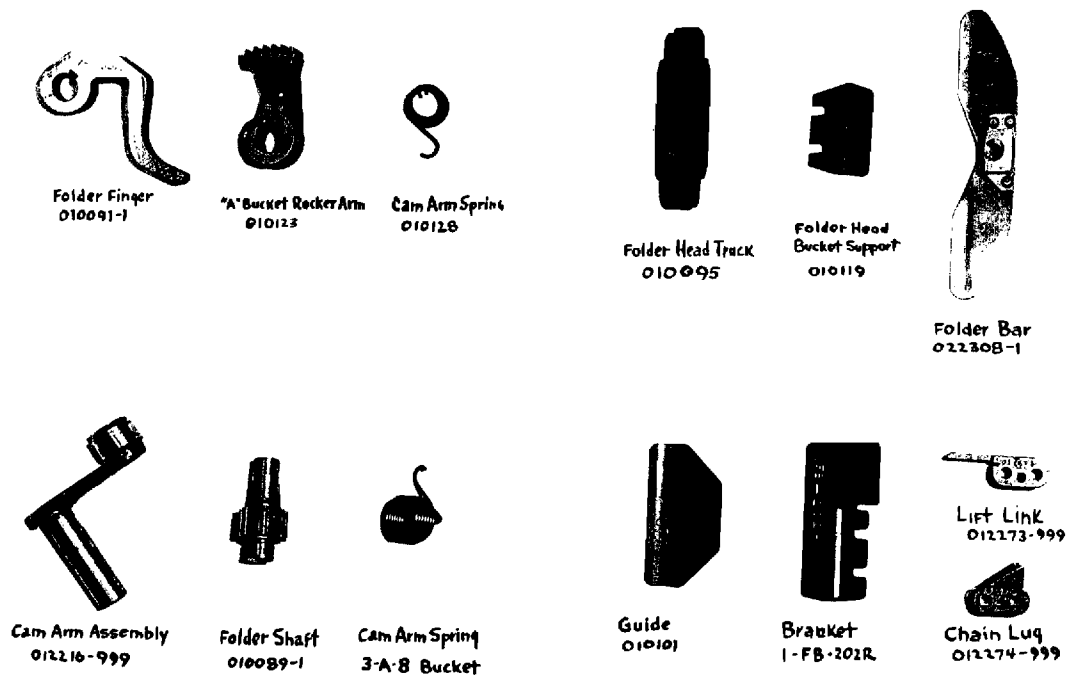


FIG. 2

Page From Proposed Pictorial Spare Parts Catalog

would be of inestimable value to the owners and users of this machinery.

The units cost nearly \$100,000 each when new, and a parts catalog of identified pictures with part names and numbers as suggested would cost approximately \$100.00 for the first and approximately \$35.00 each for all succeeding copies. To exemplify the relative inexpensiveness of this type of identification, a man's hand can hold approximately twenty-five of the cam arm assemblies, Number 012216-999. Each assembly is sold in FIG. 2 to the industrial operator for \$6.00, a total handfull costing \$150.00. The above example of the value of proper identification is just one of numerous possibilities in industrial maintenance spare parts storesrooms.

GRAPHICAL REPRESENTATION OF STOCK TURNOVER
AND ITS DESIRED RATES OF TURNOVER

IMPROVE TURNOVER TO ADD TO PROFITS

The following information is quoted from "How to Get Profits From Inventories", a publication of Remington Rand Incorporated

Turnover of stock affects the entire operation of a business because profits come from goods that move and not those that lie in the stock bins. Skill in controlling inventory is one of the most important tests of business management. Without effective inventory control a thriving business can quickly become unprofitable - as a result of losses suffered on excessive or unbalanced stocks. Government statistics show that this is one of the most common causes of business failure.

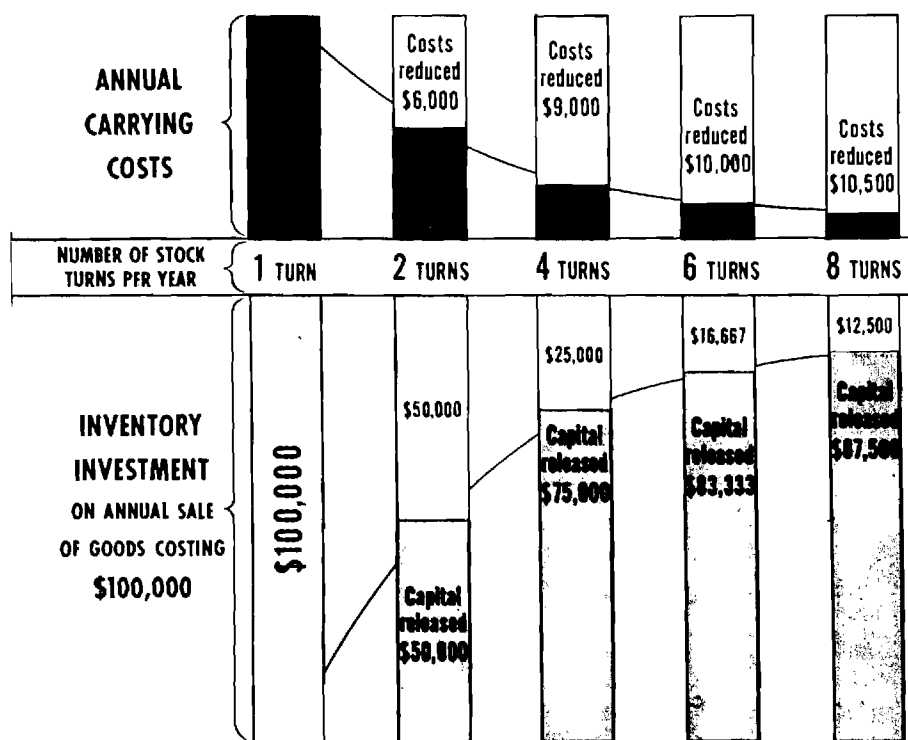


FIG. 3

Reduction of Carrying Costs Aided by Reducing Inventory Investment,
Improving Turnover of Inventory

The burden of slow inventories is graphically illustrated in the chart below. Not only is capital tied up in inventory - capital which might be profitably employed elsewhere - but ever-mounting carrying costs eat into profit. The interest on money invested in stock, the shipping and handling costs, the costs of storage and insurance, the wages of people required to handle excess stock, the losses due to obsolescence and mark-downs - these carrying costs amount to at least 12% of the value of the goods each year. Some companies keeping careful cost records have found annual carrying costs running as high as 18% to 20% of inventory value! Thus inventory eats up over 1% of its value every month!

Tremendous profit-building forces are released by maintaining closer control over inventory and improving turnover. The chart shows what can be accomplished in any business, large or small. It will give you a quick indication of the substantial savings you can create through the simplified Inventory Control methods.

The greatest costs and most serious business losses occur from overstocks and slow turnover. The temptation to overbuy for the purpose of securing discounts - or the attempt to reduce costs by producing more than can be sold in a reasonable period of time - leads directly to slow turnover and high cost of possession. On the other hand, there is often a danger in too fast turnover on popular items. This results from carrying skimpy stocks and ordering so frequently, in such small amounts, that the cost of acquisition on these items goes up. Carrying skimpy stocks of fast movers means low cost of possession, but it leads to out-of-stock conditions which hamper production or cause loss of sales and customer goodwill.

The ideal turnover rate varies in different businesses. Some, such as coal and grocery concerns, make their greatest profit on 10 to 24 turnovers, but for a majority of companies, the most profitable turnover is around six or eight. As the following chart shows, the ideal turnover rate, the smallest costs and greatest profit are achieved when the cost of possession has been reduced to a moderate amount and yet ordering is not on such a hand-to-mouth basis that cost of acquisition becomes excessive.

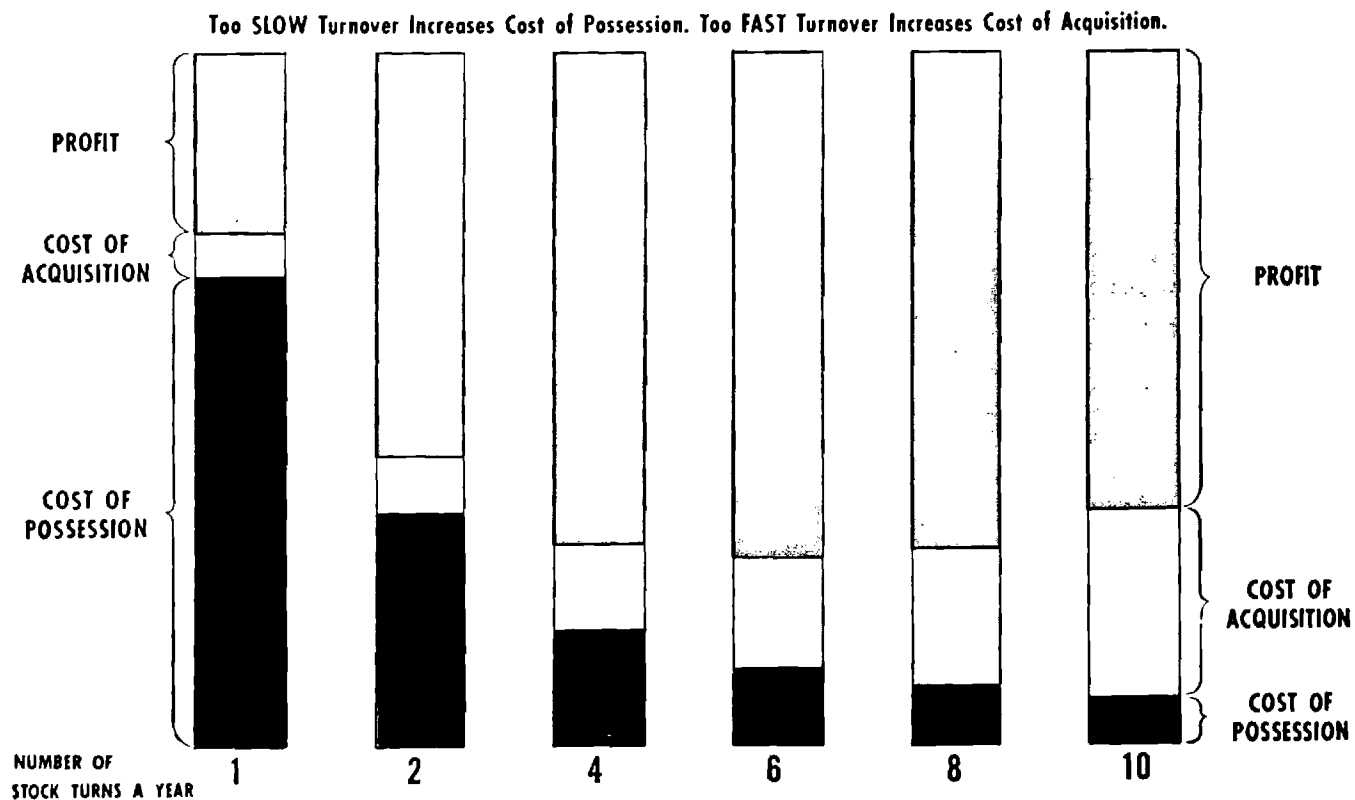


FIG. 4

Improvement of Inventory Turnover,
Up to the Point of Diminishing Returns

SOURCES OF UNPUBLISHED RESEARCH INFORMATION,
ALL OF WHICH ARE LOCATED IN OR AROUND ATLANTA, GEORGIA

Pullman Company
Yancey Brothers Company (Caterpillar)
Georgia Power Company
Ford Motor Company
Westinghouse Electric Corporation
The Holfast Rubber Company
Atlantic Steel Company
Southeastern Greyhound Company
Atlanta Paper Company
Delta Air Lines
Atlanta Transit Company
Great Southern Trucking Company
Grinnel Company
Auto Soler Company
Scripto, Incorporated

QUESTIONNAIRE USED IN PERSONAL INDUSTRIAL INTERVIEWS
OF FIFTEEN MAJOR INDUSTRIES

The purpose of this questionnaire survey is to gather certain information from local activities as a supplement to a literature survey of maintenance storesroom policy articles which are published in various periodicals. This information will be sifted and integrated into a formal paper (Graduate Thesis) which will be factual and which will not furnish identifiable confidential information to anyone.

1. Does your company have a written maintenance storesroom policy?
2. Is your machinery rented, leased, or owned by the company?
3. Who maintains the machinery used by the company?
4. Is this a branch plant?
5. Do you have a maintenance storesroom for spare parts?
6. Approximately what is your lead time on machinery spare parts orders, (a) if local, (b) if not local?
7. Are some of your spare parts custom made?
8. What is your practice of stocking custom made parts versus downtime risk on machinery?
9. What system of paper control do you use?
(Kardex, tub file, memory, or other)
10. Do you periodically purge the storesroom for obsolete parts?
11. Do you have a company-made catalog with your company-assigned part numbers for accounting and purchasing information?
12. Where is the storesroom located in your plant?
13. Did your maintenance storesroom system "just grow"?
14. Was your storesroom system planned completely before it was developed physically?
15. Does your storesroom system do your job adequately?
16. Is your storesroom system worth what it costs, in your estimation?
17. Is the total number of items stocked large enough to require a location number system for the different parts?
18. Do you have a policy of "free issue" on items which are inexpensive (such as bolts, screws, nails, etc.)?
19. What department and/or person is responsible for the storesroom activity?
20. Who has the necessary authority or responsibility to decide whether or not a certain item will become a stock item?

21. Who has the necessary authority to authorize purchase requisitions for spare parts and supplies for the maintenance spare parts storesroom?
22. Who can originate a withdrawal type requisition?
23. Do you believe that your system of keeping maintenance spare parts is the one best way?
24. Do you have metal or wooden storage bins and equipment?
25. What activity keeps the physical inventory record on balance of stores from which plant withdrawal slips are reduced?
26. Do you have a check (continuous physical inventory) on stock at all times?
27. Do you use a mathematical formula to determine your order quantity?
28. What is your procedure for taking physical inventory?
29. How long a supply of items do you endeavor to keep on hand at all times?

TABULATION OF ALL INDIVIDUAL QUESTIONS AS ANSWERED
BY EACH COMPANY; SPECIFIC ANSWERS ARE NOT KEYED TO
THE COMPANY ISSUING THE STATEMENTS

QUESTION I

Does your company have a written maintenance storesroom policy?

1. No. All stores clerks or storekeepers receive personal instruction from experienced personnel.
2. No; verbal instructions are given.
3. No.
4. Yes.
5. Not at this particular plant.
6. No.
7. Not a current one, but there has been one in the past; it will be brought up to date in the foreseeable future.
8. Yes.
9. No.
10. Yes.
11. No.
12. Yes.
13. No.
14. No.
15. Yes.

QUESTION II

Is your machinery leased, rented, or owned by the company?

1. We own the machinery.
2. Company owned; we sell new machinery and rebuild old models traded to us.
3. Our equipment is neither rented nor leased; we own it.
4. We own the equipment.
5. Company owned.
6. Owned by this company.
7. We own it.
8. Owned by the company.
9. Some owned, other leased.
10. Company owned (airplanes).
11. Company owned.
12. Some vehicles are company owned and others are leased.
13. Company owned.
14. We own our machinery.
15. Company owned.

QUESTION III

Who maintains the machinery used by the company?

1. Company maintenance department personnel.
2. Company service department.
3. We maintain it.
4. We.
5. We.
6. We.
7. We do; work is done by our mechanical department and our electrical.
8. We do.
9. We do.
10. We do.
11. We do.
12. We do, with certain limitations.
13. We do.
14. Our maintenance department.
15. We do (owner).

QUESTION IV

Is this a branch plant?

1. Yes, with relatively independent local management.
2. No.
3. No, but it is part of a large public utility system.
4. Yes.
5. Yes.
6. No.
7. No.
8. Yes.
9. No.
10. No; this is our main terminal.
11. No.
12. Yes.
13. Yes.
14. No.
15. No.

QUESTION V

Do you have a maintenance storesroom for spare parts?

1. Yes.
2. Yes; this activity also sells to customers who buy and use our equipment.
3. In some cases, yes; in others, no.
4. Yes; it acts as a tool crib also.
5. Not per se.
6. No; we have a large, locker-type cabinet which suffices.
7. Yes.
8. Yes.
9. Yes.
10. Yes.
11. Yes.
12. Yes.
13. Yes, four in this plant.
14. Yes, as a small part of the machine shop.
15. Yes.

QUESTION VI

Approximately what is your lead time on machinery spare parts orders,
(a) if local, (b) if not local?

1. (a) Thirty days, usually, but current market dictates policy.
(b) No answer available.
2. (a) No answer.
(b) Up to sixty days; the policy is dictated by the critical state of supply.
3. (a) The time varies.
(b) The time varies. We try to use thirty to sixty days as lead time except on special occasions.
4. (a) and (b) Orders are placed in accordance with the dictates of the market situation, based on experience.
5. (a) No answer.
(b) No answer.
6. (a) Telephone orders for mill supplies from local suppliers.
(b) No answer.
7. (a) Approximately five days.
(b) This time is dependent upon the nature of the need, but usually it is from twenty to thirty days.
8. (a) We buy locally on cases of emergency.
(b) Approximately one week.
9. (a) From one day to one week.
(b) From thirty to sixty days.
10. (a) No answer.
(b) Varies with the market at the time; some parts require as much as six months, and some require as much as one year.
11. (a) Average from two weeks to four weeks.
(b) From one to three months.

- 12. (a) Approximately one week.
(b) No answer.
- 13. (a) Dictated by local circumstances.
(b) No answer.
- 14. (a) We use the "emergency" approach for all
machine spare parts orders.
(b) No answer.
- 15. (a) No answer.
(b) No answer.

QUESTION VII

Are some of your spare parts custom made?

1. Yes, small wooden parts.
2. No.
3. Yes, we have a well equipped shop for such needs, but it is not a general policy.
4. No.
5. Yes.
6. No.
7. Yes.
8. No.
9. Yes.
10. Yes, in emergency cases.
11. Yes.
12. No.
13. Yes.
14. Yes, but seldom.
15. Yes; many of our perishable tools are made in our own plant maintenance department.

QUESTION VIII

What is your practice of stocking custom made parts versus downtime risk on machinery?

1. No answer.
2. Custom parts are not necessary.
3. No answer.
4. Not necessary.
5. Risk downtime on machinery because of the nature of the product. We make custom transformers.
6. No policy; we do not need custom made parts.
7. We keep a spare.
8. Not necessary.
9. We keep some required custom made parts on hand, and in some cases we risk downtime on production machinery.
10. We do not, as a practice, stock custom made parts.
11. We do not stock custom made parts.
12. This consideration is not necessary.
13. We keep critical spare parts on hand at all times, many of which are custom made.
14. We do not stock any custom made spare parts.
15. We keep a very accurate record of tool and spare parts usage, and we maintain critical custom made parts on hand at all times.

QUESTION IX

What system of paper control do you use?
(Kardex, tub file, memory, or other)

1. Ledger, but the company is in the process of changing to another type of ledger.
2. We use a combined system of Kardex, tub file, and I. B. M. equipment.
3. As a general rule, the items are expensed upon purchase because they are to be used as repairs. The accounting department uses the Acme card system for what records that are kept on such items, however.
4. Kardex.
5. None, since there is no formal storesroom for maintenance.
6. None.
7. Kardex.
8. Acme card visible files.
9. Kardex, tub file, memory.
10. Acme card visible stock cards, but we use I. B. M. cards for withdrawal slips.
11. Acme card system perpetual inventory.
12. Quarterly physical inventory only.
13. Our maintenance spare parts operation is so relatively small that we depend upon the memory of the maintenance department workers to be mindful of the spares with which they are personally familiar.
14. Memory only.
15. Kardex.

QUESTION X

Do you periodically purge the storesroom for obsolete parts?

1. Yes, but only as indicated by ledger balance.
2. Yes.
3. Yes.
4. Yes.
5. No.
6. No.
7. Yes, constantly.
8. Yes.
9. No.
10. Yes.
11. Yes.
12. No.
13. This is not necessary.
14. No.
15. Yes; this is a perpetual element of our program.

QUESTION XI

Do you have a company-made catalog with your company-assigned part numbers for accounting and purchasing information?

1. Yes.
2. No; we use the manufacturers' parts catalogs and numbers.
3. No, but there is an existing catalog which does give general accounting classifications for stores items.
4. Not for parts; we have a catalog which lists major tools as units.
5. No.
6. No.
7. No; our machinery is modern enough to have manufacturers' catalogs available.
8. No.
9. No, but we need such a system very urgently.
10. Yes; this is very essential to us in this particular operation.
11. No; we do have a general classification of items for accounting purposes, however.
12. No.
13. No; we use the catalogs of the manufacturers' of our machinery.
14. No.
15. Not as such, but we maintain engineering drawings on all of our machinery; this is an acceptable substitute for catalogs.

QUESTION XII

Where is the storesroom located in your plant?

1. In stores building; the stores department has both inside and outside storage systems for train coach parts.
2. Centrally, our "plant" is about fifty percent parts storage for customer purchase.
3. No answer.
4. In the maintenance department area.
5. In small workshop where the very limited supply of spare parts are kept without record.
6. In the tool crib, in the machine shop.
7. Centrally.
8. Back corner of building.
9. Away from maintenance area and near the receiving docks.
10. In an independent building adjacent to a repair hanger.
11. Centrally.
12. Centrally in the maintenance building.
13. Convenient locations to the operating machinery.
14. In the machine shop.
15. Centrally, in the production area.

QUESTION XIII

Did your maintenance storesroom system "just grow"?

1. No.
2. No.
3. Yes.
4. No.
5. Yes.
6. Yes.
7. No.
8. No; this is a part of our nation wide maintenance program.
9. No, but its present forward progress is nil.
10. No.
11. No.
12. Yes.
13. Yes.
14. Yes.
15. No.

QUESTION XIV

Was your storesroom system planned completely before it was developed physically?

1. Yes.
2. Yes.
3. No.
4. Yes.
5. No.
6. No.
7. Yes, considering revisions of old practices.
8. Yes.
9. Yes.
10. Yes.
11. No, but it has been constantly modified to keep in step with progressive management practices.
12. No.
13. No.
14. No.
15. Yes, with some fluid plans in mind.

QUESTION XV

Does your storesroom system do your job adequately?

1. Yes.
2. Yes.
3. It is doing the job, but we are mindful of its cost.
4. Yes.
5. Such as is necessary.
6. Yes.
7. Yes, but the growing need of space is hampering it.
8. Yes.
9. Yes, but we need more space in order to operate more satisfactorily.
10. Yes.
11. Yes.
12. Yes.
13. Yes.
14. Yes.
15. Yes.

QUESTION XVI

Is your storesroom system worth what it costs, in your estimation?

1. Yes.
2. Yes.
3. We do not have an available figure on the cost, but we do know that there is a need of revision of cost, downward.
4. Yes.
5. Yes, cost is negligible.
6. Yes, but only because of its extremely small program.
7. Yes.
8. Yes.
9. Yes, but the cost could be reduced if proper authority for supervision were granted.
10. Yes.
11. Yes.
12. Yes.
13. Yes.
14. Yes.
15. Yes.

QUESTION XVII

Is the total number of items stocked large enough to require a location number system for the different parts?

1. Yes.
2. Yes.
3. No, but we do have a general location system.
4. No.
5. No.
6. No.
7. We use a generalized location system only.
8. Yes.
9. This was in the original plans, but insufficient labor and cooperation have retarded the proper development.
10. Yes; we have a complete separate directory for this purpose.
11. Yes.
12. We do not have a location system, but one would facilitate our operation.
13. No.
14. No.
15. Yes.

QUESTION XVIII

Do you have a policy of "free issue" on items which are inexpensive (such as bolts, screws, nails, etc.)?

1. No; all issues are by requisition, and each requisition is processed completely.
2. Yes.
3. In some cases, yes.
4. Not as a general policy, but the actual situation is governed by judgment.
5. Yes.
6. All items are "free issue" to all machine shop personnel.
7. No; even one lockwasher will have complete accounting, paperwise.
8. Yes; items which cost less than \$.25 are issued in this manner.
9. Yes.
10. Yes.
11. Yes.
12. Yes.
13. All parts are "free issue", since they are expensed as maintenance repairs upon receipt from vendor.
14. Yes.
15. No.

QUESTION XIX

What department and/or person is responsible for the storesroom activity?

1. The manager of purchasing and stores, who reports to the vice president.
2. General parts manager of the company.
3. The purchasing department. The supervisor of purchasing and stores is responsible to the vice president and general manager.
4. Foreman of general stores, who is responsible to the production control manager.
5. Maintenance department; all items are expensed at time of purchase.
6. Machine shop foreman.
7. The head storekeeper, who in turn is responsible to the purchasing department.
8. The superintendent of this branch maintenance shop.
9. Purchasing department.
10. The head of the stores department, who answers directly to the vice president in charge of operations.
11. The general storekeeper, under the supervision of purchases and stores.
12. The stockkeeper is responsible to the purchasing agent, whose office is in another state.
13. Plant superintendent.
14. The maintenance supervisor, who is responsible to the factory superintendent.
15. The mechanical division.

QUESTION XX

Who has the necessary authority or responsibility to decide whether or not a certain item will become a stock item?

1. The manager of purchasing and stores, who is assisted by the foreman whose men would use the item. This must be cleared in the main office, however.
2. General parts manager.
3. The person in charge of the department which uses the item.
4. Production control manager.
5. Supervisor of storesroom who is in fact the one-man maintenance department.
6. Machine shop foreman.
7. This is a joint responsibility between the purchasing department and the maintenance department.
8. Policy is dictated by the needs of the individual repair shop, and these items are furnished by the central stores department from another city.
9. The supervisor of the storesroom, or the head of the maintenance department.
10. A joint agreement between the stores department, the engineering department, and the maintenance department is necessary.
11. An agreement by the stores department and the maintenance department, approved by the general manager is the usual method.
12. The local storekeeper.
13. Plant superintendent.
14. No answer.
15. The director of the mechanical division.

QUESTION XXI

Who has the necessary authority to authorize purchase requisitions for spare parts and supplies for the maintenance spare parts storesroom?

1. Storekeeper's office.
2. General parts manager.
3. The head of the section or department where the need exists.
4. Foreman of general stores, the plant manager, and the production manager.
5. Floor supervisor.
6. Machine shop foreman.
7. Purchasing department, from a perpetual inventory system (Kardex files).
8. Storekeeper. The foreman on duty may purchase in case of emergency when the storekeeper is not on duty.
9. Department heads, with the approval of the maintenance department.
10. The perpetual inventory clerks, with the necessary approval from proper departmental authority.
11. The general storekeeper, or the plant superintendent, or the superintendent of maintenance.
12. The local storekeeper.
13. Plant superintendent.
14. The maintenance supervisor, but they must be approved by the plant superintendent and the vice president in charge of production.
15. The director of the mechanical division.

QUESTION XXII

Who can originate a withdrawal type requisition?

1. Foreman, assistant foreman, and certain clerks.
2. These withdrawals are represented by customers' orders.
3. Predetermined individuals above the job of foreman.
4. Any worker with the approval of his department manager, and certain specified persons.
5. Any worker in plant; plant employs approximately fifty persons.
6. Machine shop personnel, if there were such a thing in this case, but, as stated before, all items are "free issue".
7. Any person from the position of foreman up.
8. Any employee in the shop.
9. All heads of departments, foreman, and other specifically designated persons.
10. Authorized maintenance personnel.
11. Some workers, all foremen, and all department heads.
12. All working mechanics in the maintenance garage.
13. Withdrawal slips are not necessary.
14. Not necessary.
15. The group leaders of maintenance groups.

QUESTION XXIII

Do you believe that your system of keeping maintenance spare parts is the one best way?

1. No.
2. Approaches it, and it is satisfactory.
3. No.
4. No.
5. No.
6. No.
7. No, because we believe that all systems can be improved.
8. No, but it is very good.
9. No.
10. No. This system is changed often to better fulfill our needs.
11. No.
12. We consider ours a satisfactory system.
13. No.
14. No.
15. No, but it is satisfactory.

QUESTION XXIV

Do you have metal or wooden storage bins and equipment?

1. Metal.
2. Metal.
3. Metal, wooden, and open yard storage. We are standardizing to metal bins and equipment, and removing, gradually, wooden equipment.
4. Metal equipment.
5. Metal.
6. Wooden cabinet.
7. Some of both.
8. Metal.
9. Metal.
10. Metal bins.
11. Both.
12. Metal.
13. We have wooden shelves in open rooms.
14. Both.
15. Metal.

QUESTION XXV

What activity keeps the physical inventory record on balance of stores from which plant withdrawal slips are reduced?

1. Storekeeper's office, which is in the immediate area of parts storage.
2. Parts department office.
3. At location. The money record, however, is kept by the comptroller by class and lot system.
4. No answer.
5. None are kept.
6. None are kept.
7. Purchasing department office.
8. Local storesroom.
9. Purchasing department.
10. Stores department perpetual inventory section.
11. The main stores office.
12. None. The accounting department maintains a total figure of value on its books.
13. No one.
14. No permanent record is kept; all such items are charged to expense when received.
15. The mechanical division.

QUESTION XXVI

Do you have a check (continuous physical inventory) on stock at all times?

1. No.
2. Yes.
3. Yes.
4. No.
5. No.
6. No.
7. No; we take a physical inventory each six months.
8. Yes.
9. No, but each time a specific item is reordered, a physical count is made.
10. Yes.
11. Yes.
12. We take a quarterly inventory only.
13. No.
14. No.
15. No, however we take a physical inventory of this activity each thirty days.

QUESTION XXVII

Do you use a mathematical formula to determine your order quantity?

1. No; we use previous issue history information as a guide.
2. Yes; it determines the average two months' usage during the preceding twelve months.
3. No, we use past experience and present judgment.
4. No answer.
5. No answer.
6. No.
7. No, we buy in accordance with experience.
8. No. Many of our parts become obsolete at an early age because of model changes.
9. No. The majority of the spare parts issued are to replace broken parts rather than worn out parts, and there has been no determination of prospective breakage.
10. No.
11. No; we use past experience and judgment, with the viewpoint of vehicle obsolescence in mind.
12. No; we order from experience.
13. No.
14. No.
15. No.

QUESTION XXVIII

What is your procedure for taking physical inventory?

1. A person records into the inventory ledger the inventory of items as called by a person who is actually counting in the bins.
2. Two station telephone system; this uses minimum personnel.
3. Since this equipment has been expensed as repair parts, there is very little need for physical inventory.
4. No answer.
5. No physical inventory in this particular activity.
6. None is taken.
7. The purchasing department prepares a list of items as represented on the inventory cards, the stores department then records the physical inventory on the list. These figures are then transferred to the perpetual inventory cards in the purchasing department.
8. Storekeeper takes stock of each item before reordering, and complete physical inventory is taken annually.
9. A preprinted inventory slip is placed in the proper bin so that identification will be positive, counting personnel are then instructed to make the physical count, record it on the slip and mark the bin as having been inventoried. The marked slips or tickets are then collected in "families".
10. The stock cards are arranged in flat drawers so that the description of each part may be read from the bottom of the respective cards; a photostat positive print is made of the entire face of the open drawer, and the resulting white background picture with the descriptions thereon serves as a blank inventory list to be posted as each item is counted.
11. No answer.
12. No answer.

13. None is taken.
14. None is taken.
15. We check the stock on hand against the Kardex inventory cards.

QUESTION XXIX

How long a supply of items do you endeavor to keep on hand at all times?

1. Six months supply.
2. Two months supply.
3. We try to keep a ninety day level of supply of the more expensive items.
4. No answer.
5. No answer.
6. Only that needed when order is placed.
7. This is always a variable figure, tempered with the current economic situation in general business.
8. No answer.
9. The supply varies, for the usage is not uniform.
10. This is an indeterminate figure for us, because airplanes are usually in a fluid state of modification and prospective obsolescence.
11. No answer.
12. No answer.
13. We do not have a uniform practice with respect to our stock of spare parts.
14. To serve only the emergency on hand.
15. Our time supply of any item requirement is always available.

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